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MEMORANDUM FOR: Deputy Director (Research)

SUBJECT : Summary of Report on U-2 Generator Problem

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1. A visit was made by [REDACTED] to Lockheed Aircraft Corp., Burbank, Calif. and to [REDACTED] Santa Monica, California, 15-19 March to investigate the recent U-2 generator problem. A detailed report of the visit is on file in the Materiel Division, OSA.

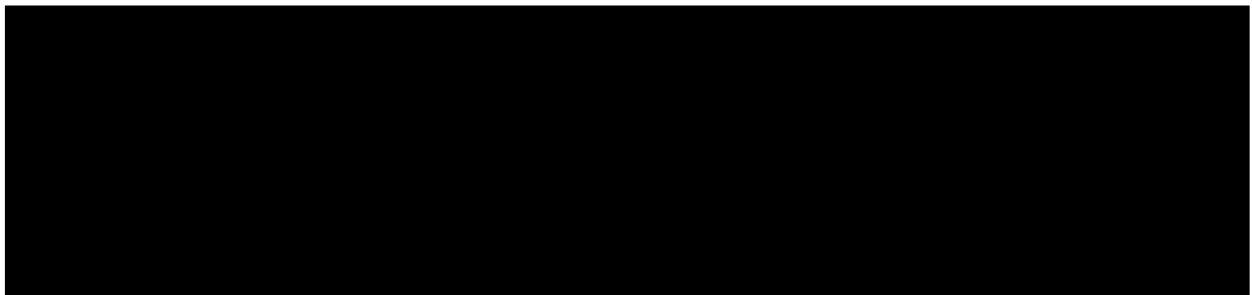
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2. Two specific problems were investigated:

a. The sudden and rapid wear-out rate of generator brushes.

b. The high failure rate of generator drive-end bearings.

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4. Summary of brush problem:

a. Brush failures are attributed to the loss of the protective coating on the commutator and not to "soft" brushes as was thought originally. The protective coating is applied by the brush during break-in and acts as a friction reducer between the brush and the commutator. Dr. [REDACTED] stated that loss of this coating was the only factor which could cause the rapid brush wear we have experienced. The loss of coating could be caused by excessive brush pressure, arcing, increased speed of the commutator or improper build-up of the coating during break-in. The first three causes did not exist.

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Handle via [REDACTED]
Control System

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b. A visit to the [] plant revealed that generators were being run-in in a room filled with fumes from a nearby degreasing vat. [] stated that the fumes contained chlorinated hydrocarbons which reacted chemically with the coatings on the commutators causing them to be of extremely limited durability. [] was directed and agreed to do all further overhaul work at the Cleveland plant until the fume problem at the [] plant was corrected.

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c. [] discarded the "hard" vs "soft" brush theory. He was supported in this respect by the results of an LAC test in which both "hard" and "soft" brushes wore equally during a four hour flight test on the same generator.

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d. It was learned that [] had no written specifications and no quality inspection procedures for the brushes they purchased from []. Brushes are procured according to grade with [] accepting [] certification of grade. At our request, [] agreed to establish specifications and quality inspection procedures to insure top quality brushes are obtained for our program.

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e. [] was requested and agreed to perform a physical and chemical analysis on our defective brushes and to report his findings to [] and LAC. He was also requested to have his company tighten up their QC procedures and to furnish [] with brushes of only top quality and hardness.

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f. LAC will run selective QC inspections on all new brushes to determine that they meet the newly listed specifications.

5. Summary of bearing problem:

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a. Both [] bearings were used in the generators. The original bearing problem was caused by defective [] bearings. A quantity of these bearings (actual number unknown) failed to meet tolerance specs -- the balls were too tight in the raceway. This caused overheating, "freezing" and failure.

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b. In January 1963, [] erroneously analyzed this problem as "improper grease" and prescribed a new high temp grease. However within a few hours flight time, the new grease reacted chemically with the elastimer seals, causing them to breakdown and lose grease from the bearings. Generator failure followed. This occurred the first week in February.

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c. LAC urgently requested help from [REDACTED] in analyzing this problem but from what could be determined, received little help. It was at this stage that LAC discovered the defective [REDACTED] bearings and the incompatibility of the high temp grease with the elastimer seals. An immediate overhaul program was worked out with [REDACTED] to replace all [REDACTED] bearings with [REDACTED] bearings and to replace the high temp grease with MIL Spec grease Mil G-3545. Once again [REDACTED] used bad judgment in that they reused many of the old seals instead of replacing with new ones. They stated they were unable to get new ones quickly enough to meet delivery schedules and "thought the old ones would do the job." Grease leakage resulted, and again the generators were declared unserviceable. This occurred the second week in March. 25X1A5a1 25X1A5a2

d. On 15 March, LAC requested [REDACTED] to replace all [REDACTED] bearings with [REDACTED] bearings. [REDACTED] resisted the request and offered several excuses for not complying. Early on 16 March, they attempted to substitute [REDACTED] bearings but were told emphatically by LAC that only [REDACTED] bearings would be accepted. [REDACTED] bearings were finally obtained late in the day and arrangements were made for [REDACTED] to test one in the altitude chamber at the Cleveland plant. Simultaneously, [REDACTED] arranged to commence modifying generators with new bearings and brushes at Cleveland. 25X1A5a1

e. After 17 hours of testing, the [REDACTED] bearing and the new brushes were declared acceptable by [REDACTED]. Bearing and brush temperatures were normal. There was no grease leakage. These tests were completed 18 March. 25X1A5a2

f. LAC obtained the first five modified generators late Sunday night, 17 March and set up a flight test program beginning 18 March. The first phase of this program was completed 20 March after obtaining 21½ hours on one generator and 7 hours on another. Bearings, seals, brushes and protective coatings on commutators were normal. Testing of one generator will continue for a total of 100 hours after which a teardown inspection will be performed on all vital parts. From this, a life cycle projection will be made.

6. In conclusion, it is a fair statement that LAC took the initiative on these problems and applied their full resources around-the-clock to solve them. On the other hand, there is ample evidence of an indifferent and uncooperative attitude on the part of [REDACTED] during this period. This is borne out by

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their delay in investigating the brush problem, carelessness in investigating and analyzing the bearing problems, resistance to procuring [REDACTED] bearings when requested by LAC, unsatisfactory overhaul procedures, poor quality control, procrastination in providing urgently needed information to LAC, repeatedly providing wrong information, and willingness to accept something less than perfection even after being impressed with the importance of the program.

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7. We have requested LAC to expedite the testing of a [REDACTED] generator as replacement for the [REDACTED]. Initial tests indicate the Bendix to be a superior product with the higher output required for our ECM equipment. LAC will submit an ECP on this item in about three weeks.

JACK C. LEDFORD
Colonel USAF
Assistant Director
(Special Activities)

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MD/OSA-DD/[REDACTED]:jw (22Mar '63)

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